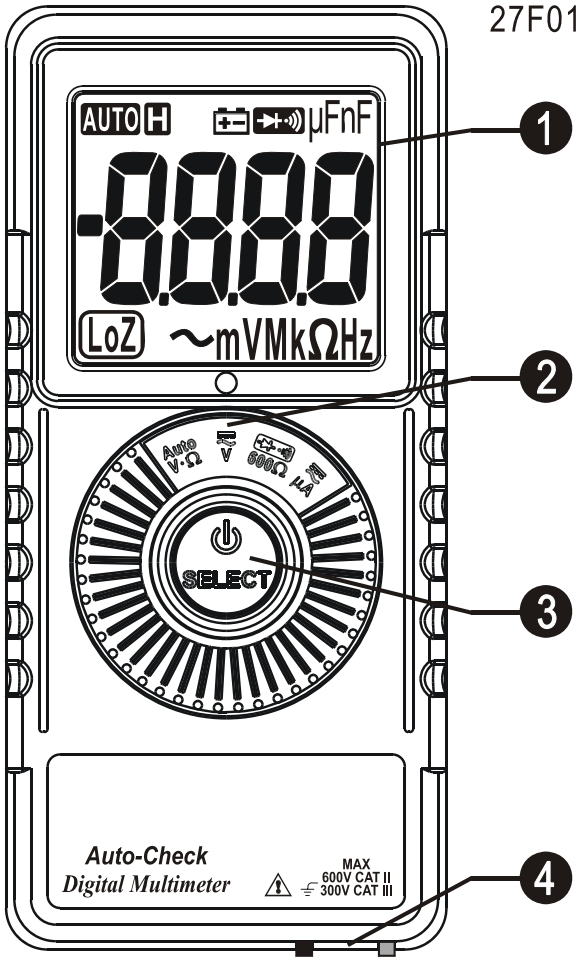

BM22, BM25 & BM27 USER'S MANUAL

1) PRODUCT DESCRIPTION

Note: Top of the line model is used as representative for illustration purposes. Please refer to your respective model for function availability.

1) LCD display

2) Rotary Selector to Select additional functions (BM27 & BM22 only), and to turn the Power On or Off (BM22 only). BM25 does not have a physical Rotary Selector.

3) Push-button to Select additional functions (all models), and to switch the Power On or Off (BM27 & BM25 only)

4) Input for all functions, or otherwise specified. Red test lead for positive (+) polarity and Black test lead for Ground reference (-)

2) SAFETY

Terms in this manual

WARNING identifies conditions and actions that could result in serious injury or even death to the user.
CAUTION identifies conditions and actions that could cause damage or malfunction in the instrument.

This manual contains information and warnings that must be followed for operating the instrument safely and maintaining the instrument in a safe operating condition. If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired. The meter is intended only for indoor use. The meter is protected, against the users, by double insulation per EN61010-1, IEC61010-1, CSA C22.2 No. 1010.1-92 and UL61010B-1 to CAT III 300V & CAT II 600V (CAT II 450V for model BM25).

Measurement Category III (CAT III) is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit-breakers, wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with permanent connection to the fixed installation.

Measurement Category II (CAT II) is for measurements performed on circuits directly connected to the low voltage installation. Examples are measurements on household appliances, portable tools and similar equipment.

WARNING

To reduce the risk of fire or electric shock, do not expose this product to rain or moisture. To avoid electrical shock hazard, observe the proper safety precautions when working with voltages above 60 VDC or 30 VAC rms. These voltage levels pose a potential shock hazard to the user. Do not touch test lead tips or the circuit being tested while power is applied to the circuit being measured. Keep your fingers behind the finger guards of the test leads during measurement. Inspect test leads and probes for damaged insulation or exposed metal before using the instrument. If any defects are found, replace them immediately.

INTERNATIONAL ELECTRICAL SYMBOLS

⚠	Caution ! Refer to the explanation in this Manual
⚠	Caution ! Risk of electric shock
⏚	Earth (Ground)
▣	Double Insulation or Reinforced insulation
▭	Fuse
~	AC--Alternating Current
⎓	DC--Direct Current

3) CENELEC DIRECTIVES

The instrument conforms to CENELEC Low-voltage directive 73/23/EEC and Electromagnetic compatibility directive 89/336/EEC

4) OPERATION

Note: All function operations described hereafter are via the Red test lead for positive (+) polarity and Black test lead for Ground reference (-), or otherwise specified

4-1) FUNCTIONS IN "Auto V.Ω" POSITION (BM27 & BM25 only)

-Quick Start (BM27 & BM25 only)

AutoCheck™ mode is the default function in "Auto V.Ω" position. Press the SELECT button momentarily to select and step through the functions: *AutoCheck™→Continuity→EF→ACV→DCV→Ω→Hz→Cx→AutoCheck™*

-AutoCheck™ mode (BM27 & BM25 only)

This innovative AutoCheck™ feature automatically selects measurement function of DCV, ACV or Resistance (Ω) based on the input via the test leads.

●With no input, the meter displays "Auto" when it is ready.

●With no voltage signal but a resistance below 6MΩ is present, the meter displays the resistance value. When below 25Ω is present, the meter (BM27only) further gives a continuity beep tone.

●When a signal above the threshold of DC 1.2V or AC 1.5V up to the rated 600V (450V for BM25) is present, the meter displays the appropriate voltage value in DC or AC, whichever larger in peak magnitude.

●*Overload-Alert Feature:* When above rated 600V (450V for BM25) is present, the meter displays "OL" with a warning beep tone. Disconnect the test leads from the signal immediately to avoid hazards.

Note:

**Range-Lock Feature:* When a measurement reading is being displayed in AutoCheck™ mode, press the SELECT button momentarily 1 time can lock the function-range it was in. The LCD annunciator " AUTO" turns off. Range-lock can speed up repetitive measurements. Press the SELECT button momentarily again to return to AutoCheck™ mode.*

**Hazardous-Alert:* When making resistance measurements in AutoCheck™ mode, an unexpected display of voltage readings alerts you that the part under test is still energized.*

**AutoCheck™ nominal input impedances are slightly lower than that of common digital multimeters. They are, in fact, more similar to that of most traditional analog multimeters. "LoZ" will display on the LCD to remind the users in such cases. Although not likely, if such impedance might damage your circuits, use the common impedance (Hi-Z) voltage mode (BM27 and BM22 only) for making voltage measurements on them.*

-Continuity, Audible With Symbolic Display (BM27 & BM25 only)

From AutoCheck™ with "Auto" being displayed, press the SELECT button momentarily 1 time to select Continuity function. The meter displays a symbolic open-switch display "- -" when it is ready. Continuity is convenient for checking wiring connections and operation of switches. A continuous beep tone with a symbolic closed-switch display "----" indicates a complete circuit. In noisy environments, it is helpful to "see" continuity measurements.

-Electric Field EF-Detection (BM27 & BM25 only)

From AutoCheck™ with "Auto" being displayed, press the SELECT button momentarily 2 times to select EF-Detection feature. The meter displays "EF" when it is ready. Signal strength is indicated as a series of bar-graph segments on the display and variable beep tones.

●*Non-Contact EF-Detection:* An antenna is located at the top left corner of the meter, which detects electric field surrounds current-carrying conductors. It is ideal for tracing live wiring connections, locating wiring breakage and to distinguish between live or earth connections.

●*Probe-Contact EF-Detection:* For more precise indication of live wires, such as distinguishing between live and ground sockets, use the Red (+) test probe for direct contact measurements.

-V and Ω of AutoCheck™ In Manual Selection (BM27 & BM25 only)

From AutoCheck™ with "Auto" being displayed, press the SELECT button momentarily 3 times to select ACV, 4 times to select DCV and 5 times to select Resistance (Ω) functions of AutoCheck™. Such selected function remains auto-ranging.

-Frequency And Capacitance (BM27 & BM25 only)

From AutoCheck™ with "Auto" being displayed, press the SELECT button momentarily 6 times to select Frequency (Hz), 7 times to select Capacitance (F) functions and 8 times to return to AutoCheck™ mode.

Note:

**Unlike the Line Level Hz Frequency function (for BM27 only) as stated, this (Common) Hz Frequency function is set only at the highest input sensitivity mainly for measuring small electronic signals of below 20VAC rms.*

4-2) OTHER FUNCTIONS

-DCV, ACV & Line-Level Hz functions (BM27 only)

Rotate the rotary selector to the V position selects common impedance (Hi-Z) voltage measurements. DCV is the default function. Press SELECT button momentarily to select ACV. The AC annunciator "~" turns on. Press momentarily again to activate the Line-Level Hz function.

Note:

**Line-Level Hz input sensitivity varies automatically with ACV range selected when Line-Level Hz is selected. AC 6V range has the highest and AC 600V range has the lowest sensitivity. Measuring the signal in ACV function WHILE selecting Line-Level Hz function in that ACV range automatically sets the most appropriate sensitivity for higher voltage applications. This can avoid electrical noises as in 110/220V line voltage applications for example. If the reading shows zero due to insufficient signal levels, select Line-Level Hz function BEFORE making measurements (at AC 6V range) will set the highest sensitivity.*

-Diode & 600Ω functions (BM27 only)

Rotate the rotary selector to the ⏩/600Ω position.

Diode test is the default function. The reading shows the approximate voltage drop across the test leads. Normal forward voltage drop (forward biased) for a good silicon diode is between 0.400V to 0.900V. A reading higher than that indicates a leaky diode (defective). A zero reading indicates a shorted diode (defective), and the meter will give a long beep as continuity warning. An OL indicates an open diode (defective). Reverse the test leads connections (reverse biased) across the diode. The digital display shows OL if the diode is good. Any other readings indicate the diode is resistive or shorted (defective).

Press SELECT button momentarily selects the lowest 600Ω range for lower resistance measurements. It is an extended range to complement the AutoCheck™ Resistance (Ω) function.

-DC-μA & AC-μA Micro-Amp functions (BM27 only)

Rotate the rotary selector to the μA position. The display-reading unit is in μA although there is no unit annunciator on the display. DC-μA is the default function. There is no annunciator for DC. Press SELECT button momentarily to select AC-μA. The AC annunciator "~" turns on. These ranges, like other functions, are protected up to the maximum rated voltages of the meter.

-DCV & ACV functions (BM22 only)
Rotate the rotary selector to the V position selects common impedance (Hi-Z) voltage measurements. DCV is the default function. The DC annunciator "⎓" turns on. Press SELECT button momentarily to select ACV. The AC annunciator "∿" turns on.

-Resistance, Continuity, Diode & Capacitance functions (BM22 only)
Rotate the rotary selector to the Ω/•))/⊣/⊣⊢ position. Resistance "Ω"is the default function.
Press SELECT button momentarily selects Continuity function. The Audible annunciator "•))" turns on. Continuity is convenient for checking wiring connections and operation of switches. A continuous beep tone indicates a complete circuit.
Press SELECT button momentarily AGAIN selects Diode test function. The annunciator "⊣" turns on. The reading shows the approximate voltage drop across the test leads. Normal forward voltage drop (forward biased) for a good silicon diode is between 0.400V to 0.900V. A reading higher than that indicates a leaky diode (defective). A zero reading indicates a shorted diode (defective). An OL indicates an open diode (defective). Reverse the test leads connections (reverse biased) across the diode. The digital display shows OL if the diode is good. Any other readings indicate the diode is resistive or shorted (defective).
Press SELECT button momentarily AGAIN selects Capacitance function.

-Frequency function (BM22 only)
Rotate the rotary selector to the Hz position selects Frequency function.
**Unlike the Line Level Hz Frequency function (for BM27 only) as stated, this (Common) Hz Frequency function is set only at the highest input sensitivity mainly for measuring small electronic signals of below 20VAC rms.*

4-3) OTHER FEATURES
-Power On & Off
For models BM27 and BM25, press and hold the SELECT button for 1 second and then release to turn the power ON or OFF. Press and hold the SELECT button for approximately 6 seconds to master reset the system to the default stage if in case the meter hangs up unexpectedly.
For model BM22, rotate the rotary selector to turn the power ON or OFF.

-Auto Power Off
Models BM27 and BM25 turn off intelligently after approximately 3 minutes of idle measurement readings and no button/switch activities. Model BM22 turns off automatically after approximately 30 minutes of only no button/switch activities.

-HOLD H and *30ms MAX* H features (BM22 only)
The Hold feature freezes the display for later viewing. Press the HOLD H (*MAX* H) button momentarily to activate or to exit the Hold feature.
The Max feature captures voltage signals that have durations as short as 30ms (milliseconds) within a single range, and has automatic up range capability. This mode is available in DCV & ACV functions. Press the HOLD H (*MAX* H) button for 1 second or more to activate or to exit the Max feature.

-Auto-ranging
If the function selected has more than one range, the meter will auto-range to the best range and resolution. No manual ranging is required.

5) MAINTENANCE

WARNING

To avoid electrical shock, disconnect test leads from live circuits before opening the case. Do not operate with open case.

Cleaning and Storage

Periodically wipe the case with a damp cloth and mild detergent; do not use abrasives or solvents. If the meter is not to be used for periods of longer than 60 days, remove the battery and store it separately

Trouble Shooting

If the instrument fails to operate, check battery, leads, etc., and replace as necessary. Double check operating procedure as described in this user's manual

If the instrument voltage-resistance input has subjected to high voltage transient (mostly caused by lightning or switching surge to your system) by accident or abnormal conditions of operation, the series fusible resistors will be blown off (become high impedance) like fuses to protect the user and the instrument. Most measuring functions through this input will then be open circuit. The series fusible resistors and the spark gaps should then be replaced by qualified technician. Refer to the LIMITED WARRANTY section for obtaining warranty or repairing service.

Battery replacement

If the meter starts up with persistent resetting display or with low battery icon turns on, replace the battery ASAP. The meter uses one 3V coin battery IEC-CR2032.

Before opening the case bottom, make sure the meter is switched off to avoid abrupt power reset to a running meter system. Disconnect test leads from live circuits. Loosen the screw from the case bottom. Lift the end of the case bottom nearest the input test leads until it unsnaps from the case top. Replace the battery. Observe battery polarities with positive (+) faces up (towards the case bottom). Replace the case bottom, and ensure that the snap on the case top (near the LCD side) is engaged. Re-fasten the screw.

Note for BM27 and BM25 battery replacement:

**BM27 and BM25 use micro-controller (like a computer) to run the meter system. WHEN THE METER IS POWER-ON, intermittence battery power failure (fast intermittence battery contact interval in the order of millisecond) may cause the meter reset/re-startup abnormally. Simply press and hold the SELECT button for approximately 6 seconds to master reset the system if such a situation occurs.*

6) SPECIFICATION

GENERAL SPECIFICATIONS

Display & Update Rate:

BM22: 3-3/4 digits 4000 counts; Updates 3 per second nominal

BM25 & BM27: 3-5/6 digits 6000 counts; Updates 5 per second nominal

Operating Temperature: $0^{o}C \sim 40^{o}C$

Relative Humidity: Maximum relative humidity 80% for temperature up to $31^{o}C$ decreasing linearly to 50% relative humidity at $40^{o}C$

Altitude: Operating below 2000m

Storage Temperature: $-20^{o}C \sim 60^{o}C$, < 80% R.H. (with battery removed)

Temperature Coefficient: Nominal 0.15 x (specified accuracy)/ ^{o}C @ ($0^{o}C \sim 18^{o}C$ or $28^{o}C \sim 40^{o}C$), or otherwise specified

Sensing: Average sensing

Pollution Degree: 2

Safety: Meets IEC61010-1, UL61010B-1, CAN/CSA-C22.2 No. 1010.1-92

Transient Protection: 4kV lightning surge (1.2/50μs)

Measurement Category:
BM22 & BM27: CAT II 600V and CAT III 300V
BM25: CAT II 450V and CAT III 300V
E.M.C.: Meets EN61326 (1997, 1998/A1), EN61000- 4-2 (1995), & EN61000-4-3 (1996)
In an RF Field of 3V/m:
Capacitance function is not specified
Other function ranges:
Total accuracy = Specified accuracy + 45d
Performance above 3V/m is not specified
Overload Protection:
BM22 & BM27: 600VDC & VAC rms
BM25: 450VDC & VAC rms
Low Battery: Below approx. 2.4V
Power Supply: 3V standard button battery x 1 (IEC-CR2032; ANSI-NEDA-5004LC)
Power Consumption (typical):
BM22 & BM25: 2mA
BM27: 6mA for Voltage functions on Auto-VΩ position, and 2mA for other functions
APO Consumption (typical): 2.2μA
APO Timing:
BM22: Idle for 30 minutes
BM25 & BM27: Idle for 3 minutes
Dimension / Weight: L113mm x W53mm x H10.2mm / Approx. 78 gm
Special Features:
BM22: Data Hold, and 30ms MAX Hold
BM25 & BM27: AutoCheck™ (Automatic V & Ω Selection), and EF-Detection
Accessories: Battery installed, and User's manual
Optional Accessories: BH-20R protective holster, and BSC-20 soft carrying pouch

Electrical Specification
Accuracy is given as +/- (% of reading digits + number of digits) or otherwise specified @ 23°C +/- 5°C and less than 75% R.H.

DC Voltage (BM25 & BM27)

RANGE	Accuracy
6.000V	0.5%+3d
60.00V	1.0%+5d
450.0V 1)	1.2%+5d
600.0V 2)	2.0%+5d
600.0V 3)	1.5%+5d

BM25 Input Impedance:
AutoCheck™ Lo-Z DCV: 160kΩ, 160pF nominal
BM27 Input Impedance:
AutoCheck™ Lo-Z DCV: 833kΩ (4.2kΩ when displaying "Auto"), 90pF nominal
Hi-Z DCV: 5MΩ, 90pF nominal
NMRR: > 30dB @ 50Hz/60Hz
CMRR: > 100dB @ DC, 50Hz/60Hz; Rs=1kΩ

DCV AutoCheck™ Threshold:
> +1.2VDC or < -0.6VDC nominal
1)BM25 AutoCheck™ DCV only
2)BM27 AutoCheck™ DCV only
3)BM27 Hi-Z DCV only

DC Voltage (BM22)

RANGE	Accuracy
400.0mV	1.0%+2d
4.000V, 40.00V, 400.0V	2.0%+2d
600V	2.5%+4d

NMRR: > 50dB @ 50Hz/60Hz
CMRR: > 120dB @ DC, 50Hz/60Hz; Rs=1kΩ
Input Impedance: 10 MΩ, 30pF nominal; (1000MΩ for 400.0mV range)

AC Voltage (BM25 & BM27)

RANGE	Accuracy
50Hz -- 60Hz	
6.000V, 60.00V, 450.0V [1], 600.0V [2]	1.5%+5d

CMRR: > 60dB @ DC to 60Hz, Rs=1kΩ
BM25 Input Impedance:
AutoCheck™ Lo-Z ACV: 160kΩ, 160pF nominal
BM27 Input Impedance:
AutoCheckTM Lo-Z ACV: 833kΩ (4.2kΩ when displaying "Auto"), 90pF nominal
Hi-Z ACV: 5MΩ, 90pF nominal
ACV AutoCheck™ Threshold:
> 1.5VAC (50/60Hz) nominal
[1]Range for BM25 only
[2]Range for BM27 only

AC Voltage (BM22)

RANGE	Accuracy
50Hz -- 60Hz	
4.000V, 40.00V, 400.0V	2.0%+5d
60Hz -- 500Hz	
4.000V, 40.00V, 400.0V	3.0%+5d
50Hz -- 500Hz	
600V	3.5%+5d

Input Impedance: 10 MΩ, 30pF nominal
CMRR: > 60dB @ DC to 60Hz, Rs=1kΩ

Capacitance (BM25 & BM27)

RANGE [1]	Accuracy [2]
100.0nF, 1000nF, 10.00μF, 100.0μF [3], 2000μF [4]	3.5%+6d [5]

[1]Accuracy below 50nF is not specified
[2]Accuracies with film capacitor or better
[3]BM25 top range. Updates > 1 minute on large values
[4]BM27 only. Updates > 1 minute on large values
[5]Specified with battery voltage above 2.8V (half full battery). Accuracy decreases gradually to 12% at low battery warning voltage of approx 2.4V

Capacitance (BM22)

RANGE [1]	Accuracy [2]
500.0nF, 5.000μF, 50.00μF, 500.0μF, 3000μF [3]	3.5%+6d [4]

[1]Additional 50.00nF range accuracy is not specified.
[2]Accuracies with film capacitor or better.
[3]Updates > 1 minute on large values
[4]Specified with battery voltage above 2.8V (half full battery). Accuracy decreases gradually to 12% at low battery warning voltage of approx 2.4V

Ohms (BM25 & BM27)

RANGE [1]	Accuracy
600.0Ω	2.0%+6d [2]
6.000kΩ	1.2%+6d [2])
60.00KΩ, 600.0KΩ	1.0%+4d
6.000MΩ	2.0%+4d

Open Circuit Voltage: 0.4VDC typical
[1]AutoCheck™ is for 6.000kΩ ~ 6.000MΩ ranges; 600.0Ω is an independent range for BM27 only
[2]Add 40d to specified accuracy while reading is below 20% of range

Ohms (BM22)

RANGE	Accuracy
400.0Ω	1.5%+6d
4.000KΩ, 40.00KΩ, 400.0KΩ	1.0%+4d
4.000MΩ	1.5%+4d
40.00MΩ	2.5%+4d

Open Circuit Voltage: 0.4VDC typical

Hz Frequency (BM25 [1] & BM27 [1] [2])

RANGE	Accuracy	Specified at
10.00Hz -- 30.00kHz [1] [2]	0.5%+4d	< 20V Sine-rms
10.00Hz -- 999.9Hz [2]		< 600V Sine-rms

Sensitivity (Sine-rms):
[1]Hz in Auto-VΩ position: > 3V
[2]Line-level Hz in V position (BM27 only):
@ 6.000VAC range: > 3V
@ 60.00VAC range: > 6V
@ 600.0VAC range: > 60V

Hz Frequency (BM22)

RANGE [1]	Accuracy
5.000Hz -- 1.000MHz	0.5%+4d

[1]Specified at Input Voltage < 20VAC rms
Input Signal: Sine-wave, or Square-wave with duty cycle > 40% & < 70%
Sensitivity (V-peak):
5Hz -- 100kHz : > 1.3Vp
100kHz -- 500kHz : > 2.2Vp
500kHz -- 1MHz : > 4.2Vp

Diode Tester (BM22 & BM27 only)

Test Current (Typical)	Open Circuit Voltage
0.25mA for BM22 0.48mA for BM27	< 1.6VDC

DC μA Current (BM27 only)

RANGE	Accuracy	Burden Voltage
400.0μA	1.5%+3d	6mV/μA
2000μA	1.2%+3d	6mV/μA

AC μA Current (BM27 only)

RANGE	Accuracy	Burden Voltage
50Hz -- 60Hz		
400.0μA	2.0%+3d	6mV/μA
2000μA	1.5%+3d	6mV/μA

Audible Continuity Tester
Open Circuit Voltage: 0.4VDC typical
Audible Threshold:
BM25 & BM27: between 50Ω and 300Ω
BM22: between 10Ω and 120Ω

Non-Contact EF-Detection (BM25 & BM27)

Typical Voltage	Bar Graph Indication
15V to 55V	-
30V to 85V	- -
55V to 145V	- - -
85V to 190V	- - - -
above 120V	- - - - -

Indication: Bar graph segments & audible beep tones proportional to the field strength
Detection Frequency: 50/60Hz
Detection Antenna: Top left corner of the meter
Probe-Contact EF-Detection: For more precise indication of live wires, use the Red (+) probe for direct contact measurements

Guarantee

Elbro units are subject to strict quality controls. Nevertheless, we guarantee the unit against functional faults for a period of 36 months (valid with receipt only).

- Manufacturing and material faults will be corrected free of charge as long as the unit has not been opened and has been returned to us.
- Damage caused by mechanical influences or improper operation are excluded from guarantee claims.

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